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Holocene thermokarst and pingo development in the Kolyma Lowland (NE Siberia)

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Abstract

© 2018 John Wiley & Sons, Ltd. Ground ice and sedimentary records of a pingo exposure reveal insights into Holocene permafrost, landscape and climate dynamics. Early to mid-Holocene thermokarst lake deposits contain rich floral and faunal paleoassemblages, which indicate lake shrinkage and decreasing summer temperatures (chironomid-based TJuly) from 10.5 to 3.5 cal kyr BP with the warmest period between 10.5 and 8 cal kyr BP. Talik refreezing and pingo growth started about 3.5 cal kyr BP after disappearance of the lake. The isotopic composition of the pingo ice (δ18O − 17.1 ± 0.6‰, δD −144.5 ± 3.4‰, slope 5.85, deuterium excess −7.7± 1.5‰) point to the initial stage of closed-system freezing captured in the record. A differing isotopic composition within the massive ice body was found (δ18O − 21.3 ± 1.4‰, δD −165 ± 11.5‰, slope 8.13, deuterium excess 4.9± 3.2‰), probably related to the infill of dilation cracks by surface water with quasi-meteoric signature. Currently inactive syngenetic ice wedges formed in the thermokarst basin after lake drainage. The pingo preserves traces of permafrost response to climate variations in terms of ground-ice degradation (thermokarst) during the early and mid-Holocene, and aggradation (wedge-ice and pingo-ice growth) during the late Holocene.

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Keywords

bioindicators, cryolithology, hydrochemistry, Khalerchinskaya tundra, stable water isotopes

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